STATE OF CALIFORNIA
GOODWIN J. KNIGHT, Governor
DEPARTMENT OF NATURAL RESOURCES
DeWITT NELSON, Director

DIVISION OF MINES
Ferry Building, San Francisco 11
GORDON B. OAKESHOTT, Chief

MINERAL INFORMATION SERVICE

Vol. 11 June 1, 1958 No. 6

MINERAL INFORMATION SERVICE is designed to inform the public on the geology and mineral resources of California and on the usefulness of minerals and rocks, and to serve as a news release on mineral discoveries, mining operations, markets, statistics, and new publications. It is issued monthly by the California State Division of Mines. Subscription price, January through December, is $1.00.

GEM STONES

The formal mining of gem stones in California has centered about the famous gem-bearing pegmatites in the Peninsular Ranges of San Diego and Riverside Counties. These deposits have yielded tourmaline, spodumene, beryl, topaz, quartz, and garnet, and have constituted one of the few notable sources of gem stones in the United States. At other localities in California, benitoite, chrysoprase, idocrase, jade, opal, and turquoise also have been mined in formal operations. Although the San Diego and Riverside County pegmatites alone have yielded gem and specimen material with a total value of at least $2,000,000, the gem mining industry of California is small compared with other mineral industries of the state.

Gem mining in California was most active during the period 1890 to 1912; from 1880 to 1924 the state yielded about 23 percent of the gem material mined in the United States (Ball, 1937, p. 306). Although most of the mines have been idle in recent years, interest in the recovery of gem stones in California has increased markedly. This activity, however, is now undertaken mostly by thousands of hobbyists and week-end prospectors who have collected at many localities in the state. Statistics on the material thus obtained in California do not exist, but in 1953 its value constituted a significant proportion of the estimated value of $500,000 to $600,000 placed on the total gem stone production in the United States during that year (Thomson, et al., 1955).

MINERALOGY AND GEOLOGIC OCCURRENCE

The term "gem stone" in its broadest sense is applicable to almost any mineral, rock, organic material, or synthetic material that can be used in the preparation of objects for personal adornment or for other ornamental purposes. In a more restricted sense, the term is applied to natural materials of unusual beauty that are both durable and rare. These commonly are grouped in three general categories—precious stones, semi-precious stones, and organic gem materials. The organic gem materials are pearl, coral, amber, and jet. Many gemologists, however, believe that the distinction between precious stones and semi-precious stone is too arbitrary to be valid, and point out that certain specimens of so-called semi-precious stones are more valued and hence more precious than some specimens of so-called precious stones.

Only certain varieties of three minerals—diamond, corundum (varieties ruby and sapphire) and beryl (variety emerald)—are customarily designated as precious stones, but some workers also include pearl and jade. The semi-precious stones are much more numerous, and, in general are relatively rare varieties of rather common mineral species. They consist mostly of gem varieties of (1) silicates, including andalusite, benitoite, beryl, idocrase, chrysocolla, diopside, enstatite, epidote, feldspar, garnet, jadeite, lazurite, olivine, phenacite, rhodonite, sphene, spodumene, topaz, tourmaline, tremolite, and zircon; as well as varieties of quartz, such as agate, amethyst, chalcedony, chrysoprase, citrine, jasper, onyx, rock crystal, rose quartz, and tiger's eye; and (2) oxides, including anatase, cassiterite, hematite, opal, spinel and rutile. Semi-precious gem stones also include phosphates (apatite, lazulite, and turquoise), carbonates (azurite, calcite, malachite, and smithsonite) sulfate (gypsum), fluoride (fluorite), and sulfides (pyrite and sphalerite).

Diamond, corundum, and beryl have hardnesses of 7.5 (Mohs' scale) or greater, and hardnesses of 5 or more characterize most of the semi-precious stones. Some of the semi-precious group such as calcite, gypsum, and fluorite are much softer and their appeal stems from the pleasing appearance of certain varieties rather than durability. Most gem-quality materials are transparent or nearly so; but a few, including, azurite, chrysocolla, feldspar, jadeite, malachite, turquoise and the jasper variety of chalcedony, are translucent to opaque.

Some of the most valued gem stones occur as primary constituents of igneous rocks or in alluvial deposits derived from such rocks. The only known primary occurrences of diamond exist as disseminations in pipe-like bodies of an ultrabasic rock known as kimberlite. The most extensively mined of these deposits are in South Africa. Pegmatite dikes yield varieties of transparent beryl as well as gem-quality tourmaline, quartz, garnet, and spodumene. The world's best-known and most productive gem-bearing pegmatite areas are in Minas Geraes, Brazil.

Some gem stones occur in veins and as fillings of irregular cavities. Of these, opal, varieties of cryptocrystalline quartz, and turquoise are especially widespread and are mined in greatest volume. The last is believed to have been deposited largely or wholly from solutions of